Brazilian Federal Institutions as Intermediaries: Driving Digital Transformation Through Open Innovation

Joel Lima-Júnior[a*], *Kiev* Gama[b], *Jorge* Correia-Neto[c].

[a]Federal University of Pernambuco, Informatics Center, Recife, Brazil, jalj@cin.ufpe.br, https://orcid.org/0000-0002-0738-6351.

[b]Federal University of Pernambuco, Informatics Center, Recife, Brazil, kiev@cin.ufpe.br, https://orcid.org/0000-0003-1508-6196.

[c]Federal Rural University of Pernambuco, Distance Education Unit, Recife, Brazil, https://orcid.org/0000-0001-9977-1267.

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Abstract. The integration of Open Innovation (OI) and Digital Transformation (DT) is relevant in the public sector, particularly in developing countries where resource constraints demand innovative approaches. OI fosters collaboration between governments, businesses, academia, and civil society, enabling the co-creation of digital solutions that enhance public service efficiency and transparency. In this context, intermediaries play a fundamental role in bridging technical capabilities and institutional needs, facilitating policy implementation, and overcoming cultural and financial barriers. However, while OI and DT have been studied independently, little research has examined how intermediary-driven OI influences the digital transition in government settings. This study investigates the role of federal public institutions as intermediaries in Brazil's OI-driven DT efforts, analyzing how they facilitate innovation adoption at the state and municipal levels. Through a case study of two federal-level institutions, the research identifies key mechanisms by which intermediaries promote digital integration and examines the challenges they face, including budget limitations and resistance to change. The findings identify the strategic role of these institutions in mitigating administrative and legal barriers and in fostering cross-sector collaboration.

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1. Introduction

The pursuit of efficiency and innovation is driving the public sector globally towards strategic approaches integrating technology and collaboration. In many developing countries, DT has become essential for modernizing processes, improving service delivery, and meeting contemporary societal expectations (de Lima-Junior et al., 2024; Escobar et al., 2023). DT involves enhancing organizational performance by incorporating information, computing, communication, and connectivity technologies (Vial, 2019), a process that was once confined to the private sector.

Complementarily, OI has emerged as a valuable strategy promoting external collaboration and idea exchange to foster development and innovation (Brockman et al., 2018). Initially a the private sector concept (Biscotti et al., 2018; Bogers et al., 2016), OI is now gaining traction in the public sector due to its potential for citizen engagement in public affairs and participatory governance, enhancing collective intelligence and co-creation to address complex societal challenges (Androutsopoulou et al., 2017; Criado and Guevara-Gómez, 2021; Ferraris et al., 2020; Gascó, 2017; Mergel et al., 2019).

Although OI initiatives—especially those focusing on open government and open data—have fostered greater transparency and citizen participation in public management (Gasco-Hernandez et al., 2017; Mergel et al., 2019), most research to date has centered on citizen inclusion, with limited involvement from businesses, academia, and other public organizations (Figenschou et al., 2024).

OI has an interplay with DT where OI promotes the development of new technologies that support DT (Robertsone and Lapiņa, 2023). More recently, the integration of OI into DT efforts has gained prominence, particularly in developing countries where resource constraints and unique needs drive innovative approaches (Debeljak and Dečman, 2022; Gong et al., 2020; Mu and Wang, 2022). In this context, intermediaries play a key role by facilitating knowledge sharing and policy implementation in increasingly digital and networked environments (Mu and Wang, 2022; Palumbo et al., 2023). These intermediaries—ranging from specialized consulting firms and technology companies to nonprofit organizations—bridge the gap between technical capabilities and institutional needs, mitigating cultural, financial, and technological barriers. Recent studies have emphasized their role in supporting collaboration, reducing uncertainty, and enabling value co-creation among diverse stakeholders in innovation ecosystems (Figenschou et al., 2024; Pinto et al., 2024).

Despite these advancements, significant research gaps remain. Although DT is widely recognized as key to improving public service delivery and operational efficiency, there is a notable lack of empirical studies that explore the strategies employed –especially those involving intermediary agents in OI projects – to drive DT effectively (de Lima-Junior et al., 2024; Gong et al., 2020). Furthermore, while numerous studies have examined the success of OI in various contexts, little attention has been paid to the intersection of OI and DT in the public sector, particularly regarding how intermediary-driven OI can either facilitate or hinder the digital transition (Criado and Guevara-Gómez, 2021).

In Brazil, federal public institutions have emerged as central intermediaries in the OI process. These institutions connect diverse actors, promote the integration of digital technologies, and help overcome structural and procurement barriers (Pinto et al., 2024). This intermediation not only enhances the capacity of public agencies to adapt to technological changes but also fosters a collaborative culture among government, academia, the private sector, and civil society.

This article aims to deepen our understanding of the role of intermediaries in OI for DT within the public sector. Through a case study of two federal-level institutions acting as OI intermediaries with Brazilian states and municipalities, this research seeks to answer the following central question: *How do Brazilian federal institutions, acting as OI intermediaries, drive DT in the public sector, and what factors influence the outcomes of this process?*

This case study highlights federal intermediaries as key facilitators of technological solutions and stakeholder collaboration. Despite their role in overcoming administrative barriers, budget constraints and resistance to change remain major challenges to fully realizing DT through OI.

2. Background and Related Work

2.1. Digital Transformation in Government

DT has become fundamental for modernizing the public sector, aiming for greater efficiency and improved service delivery to citizens (Gong et al., 2020; Vial, 2019). In the governmental context, DT involves the incorporation of digital technologies to optimize administration and increase transparency (Verhoef et al., 2021). DT entails structural changes that improve operations and redefine government–society relations (Hanelt et al., 2021; Vial, 2019). This becomes particularly relevant amid growing demands for more accessible, inclusive, and personalized public services (Kraus et al., 2021).

In contrast to the private sector, public organizations face specific challenges in digitalizing their services, such as bureaucratic rigidity, limited financial resources, and cultural resistance to change (Hanelt et al., 2021; Tiach and Abdellatif, 2023). Advances in artificial intelligence, big data, and blockchain offer significant opportunities to overcome DT challenges in the public sector, enabling the automation of processes, the protection of data, and making digital services more effective (Escobar et al., 2023; Verhoef et al., 2021).

DT in public administration extends beyond internal improvements, serving as a catalyst for transparency, civic engagement, and collaborative governance (Figenschou et al., 2024). By enabling citizen participation through digital platforms, DT fosters public trust and democratic legitimacy (Edelmann et al., 2023; Palumbo et al., 2023). Central to this process is the creation of digital ecosystems that engage diverse stakeholders in co-developing solutions for key public challenges such as mobility, health, and education (Ferraris et al., 2020; Robertsone and Lapiņa, 2023).

DT requires long-term strategies that tackle institutional and cultural barriers (Gong et al., 2020; Mu and Wang, 2022). This includes investing in digital competencies for public servants, designing adaptive regulatory frameworks, and cultivating an innovation-oriented organizational culture (Edelmann et al., 2023; Tiach and Abdellatif, 2023). Recent empirical studies suggest that governments adopting strategic, participatory, and multi-stakeholder approaches to DT are more likely to improve not only operational efficiency but also public legitimacy and citizen satisfaction (Figenschou et al., 2024; Tiach and Abdellatif, 2023).

2.2. Open Innovation

OI has gained increasing importance in the public sector as a strategy to develop innovative solutions in collaboration with external actors. This model allows for combining internal resources with external knowledge to address complex challenges and improve service delivery (Bogers et al., 2018; Figenschou et al., 2024; Mu and Wang, 2022; Palumbo et al., 2023). In contemporary public and private contexts, OI enables the creation of dynamic networks that accelerate innovation and improve responsiveness to complex societal demands (Goulart et al., 2023; Pinto et al., 2024).

The knowledge exchange intrinsic to OI unfolds in both inbound and outbound flows. Inbound flows allow external contributions—such as ideas, data, and prototypes—to improve internal processes, while outbound flows disseminate innovations via partnerships, licensing, and public–private collaborations (Gasco-Hernandez et al., 2017; Mu and Wang, 2022). Particularly in the public sector, these flows are facilitated by intermediary actors and digital platforms, which expand the scope of participation and collaboration (Figenschou et al., 2024; Smith and Akram, 2017).

OI increasingly relies on active user participation, from identifying problems to co-developing solutions (Edelmann et al., 2023; Ferraris et al., 2020). This participatory logic—known as user-driven innovation, co-creation, or citizen-sourcing—enhances the legitimacy, diversity, and impact of innovation outcomes (L. and D., 2018; Palumbo et al., 2023). By embedding user engagement across multiple stages of innovation, organizations can align their outputs more closely with societal needs and expectations, especially in complex domains such as healthcare, mobility, and digital government services (Figenschou et al., 2024; Mu and Wang, 2022).

Collaborative innovation models are especially pertinent in the public sector, as they enhance both the effectiveness and legitimacy of policies and services (Criado and Guevara-Gómez, 2021; Figenschou et al., 2024). This reflects a broader transformation in digital governance, where trust, transparency, and inclusiveness are central to the creation of public value (Palumbo et al., 2023; Tiach and Abdellatif, 2023).

2.3. OI in the Public Sector

Public institutions are increasingly adopting OI to address complex challenges, inspired by its success in the private sector (Biscotti et al., 2018; Bogers et al., 2016; Gascó, 2017). OI initiatives in the public sector have expanded, driven by goals such as participatory governance, data-informed policymaking, and digital transformation (Figenschou et al., 2024; Mu and Wang, 2022; Palumbo et al., 2023). This approach enhances citizen engagement, leverages collective intelligence, and supports the development of innovative and context-sensitive solutions (Brabham, 2013; Ferraris et al., 2020). By integrating diverse actors into decision-making, OI fosters transparency, legitimacy, and efficiency, while helping to overcome bureaucratic barriers through more collaborative and responsive structures (Figenschou et al., 2024; Mu and Wang, 2022; Palumbo et al., 2023).

However, OI reveals marked differences between the private and public sectors, reflecting their distinct goals. While the private sector emphasizes product development and competitive advantage to drive economic performance (Kivleniece and Quélin, 2011), the public sector prioritizes service quality and the creation of public

value through inclusive and effective responses to social demands (Palumbo et al., 2023). Moreover, public sector OI typically involves broader stakeholder engagement—such as citizens, NGOs, and academia—highlighting its participatory and collaborative character.

2.4. Intermediaries

Public Open Innovation (POI) intermediaries are crucial strategic actors for driving collaborative innovation and DT in the public sector. They connect governments, businesses, universities, and citizens, facilitating the implementation of innovative solutions (Al Maazmi et al., 2024; Figenschou et al., 2024). In public sector contexts, their role is particularly crucial for overcoming institutional inertia and cultural resistance, enabling more inclusive, transparent, and participatory governance arrangements (Mu and Wang, 2022; Palumbo et al., 2023). By bridging gaps between stakeholders and orchestrating multi-actor efforts, intermediaries not only reduce transaction and coordination costs but also enhance the scale and impact of OI initiatives in governmental settings (Pinto et al., 2024; Smith and Akram, 2017).

One of the primary challenges faced by intermediaries in the public sector is navigating bureaucratic rigidity and inflexible organizational structures, which often hinder the implementation of collaborative innovation processes (Mu and Wang, 2022; Palumbo et al., 2023). Additionally, these organizations must operate under budgetary constraints and within highly regulated environments, conditions that can limit experimentation and adaptive governance (Figenschou et al., 2024). To overcome these barriers, intermediaries adopt strategies such as digital platforms, hackathons, and public-private partnerships, all of which support agile collaboration across sectors (Gasco-Hernandez et al., 2017; Smith and Akram, 2017).

POI intermediaries play a strategic role in fostering innovation-oriented cultures in government by developing digital and collaborative competencies among public servants (Mittal, 2020). They also enhance the resilience of public innovation ecosystems by promoting access to emerging technologies and strengthening engagement with civil society. Empirical evidence highlights a strong correlation between well-structured intermediaries and the success of digital transformation initiatives in the public sector (Al Maazmi et al., 2024; Mittal, 2020).

Recent studies have significantly expanded this understanding by incorporating dimensions such as data intermediation, digital capacity-building, and regulatory orchestration (Al Maazmi et al., 2024; Mu and Wang, 2022; Palumbo et al., 2023). These contemporary perspectives are essential to frame federal public institutions as dynamic actors within multilevel innovation ecosystems.

3. Method

3.1. Case Study

Case studies explore ongoing events by integrating evidence from various sources (Yin, 2014). Moreover, a single case may be analyzed using multiple units of analysis (Runeson, 2012). For this case study focusing on federal-level institutions acting as OI intermediaries, two units of analysis were selected. The objective is to explore how OI is driving DT in terms of activities, procedures, and interactions through intermediaries, analyzing the process from the perspective of key individuals responsible for operationalizing intermediation.

Given the exploratory nature of understanding the mechanisms by which federal institutions act as OI intermediaries to drive DT, and the need to analyze real-world practices within their specific contexts, a case study approach is particularly well-suited (Yin, 2014) using qualitative guidelines (Merriam and Tisdell, 2015).

3.2. Units of analysis

We selected the two units of analysis (Enap Challenges Platform and Serpro Ventures) through purposive sampling. Such approach allows researchers to intentionally select cases that offer rich, relevant insights into the phenomenon under study, making it ideal for qualitative research (Patton, 2014).

1. Enap Challenges Platform, led by National School of Public Administration (ENAP) through GNova, connects government and civil society to address public challenges via OI. The platform enables public

managers to launch challenges, inviting citizens, startups, and academics to propose solutions. It supports managers with toolkits, mentorships, and personalized assistance for challenge formulation and management.
2. Serpro Ventures, led by Federal Data Processing Service (SERPRO), drives DT and inclusion in federal agencies through OI. It fosters partnerships with academia, startups, research centers, and companies to develop intelligent solutions. As a federally owned company, Federal Data Processing Service (SERPRO) manages and implements IT policies for the Brazilian government.

The chosen institutions have emerged as key federal intermediaries of OI in Brazil. Enap Challenges Platform represents a model focused on broad engagement with diverse external stakeholders through open challenges, while Serpro Ventures embodies a more structured approach leveraging partnerships with specific innovation actors within the federal IT landscape. Through the Desafios Platform, ENAP has facilitated over 60 public challenges across various levels of government, fostering co-creation with startups, universities, and other actors within the innovation ecosystem. In parallel, SERPRO, through the Serpro Ventures program, has implemented approximately 200 initiatives aimed at driving DT in the public sector, combining hackathons, partnerships with ICTs, and formal co-creation models with private market actors.

The selection was informed by three main criteria: (i) the existence of structured OI mechanisms, (ii) recognition in regional or national DT agendas, and (iii) feasibility of access to relevant data and key informants. These criteria ensured the suitability of the cases for investigating the role of public intermediaries in driving DT. Their distinct yet complementary approaches enable a comparative analysis of different models and their impact on government innovation.

3.3. Data collection and analysis

For this study, documents and interviews were carefully selected to ensure data triangulation and validity (Eisenhardt, 1989; Yin, 2014). Official documents (ordinances, laws, public notices) provided information about legal frameworks, while initiative websites clarified guidelines and key actors.

Semi-structured interviews with leaders and technical staff ensured core perspectives, given the small project teams. In parallel, a systematic literature review (de Lima Júnior et al., 2024) identified four analytical dimensions—innovation approaches, stakeholders, influencing factors, and the role of technology—which informed the interview protocol and guided the processes of triangulation and thematic coding, thereby strengthening the qualitative analysis.

The interview protocol aimed to explore institutional OI practices, involved stakeholders, enabling and hindering factors, and the role of technology in DT efforts. Interviews were conducted remotely via Google Meet, with prior informed consent and subsequent transcription assisted by AI and manually refined. Participants were briefed on analytical dimensions to clarify the study's scope. A thematic analysis was performed following Braun and Clarke's approach (Braun and Clarke, 2006), combining deductive coding from predefined constructs with inductive identification of emerging themes. Initially based on four analytical dimensions, the framework evolved into five core themes: practices, stakeholders, enablers, barriers, and technologies.

3.4. Participant selection

Participants were selected based on a thorough analysis of the profiles of the key organizers of each initiative, according to information available on institutional websites. After the initial contact with the organizations and the presentation of the research objectives, the interviewees promptly expressed their interest in contributing. Consequently, two key individuals per initiative were selected, following the criterion that they should hold strategic positions in the planning, coordination, and execution of the full OI cycle. A detailed description of the interviewees' profiles can be found in Table 1.

4. Results

4.1. Enap Challenges Platform

Enap Challenges Platform connects public agencies with startups, universities, and citizens to solve public challenges via the Desafios platform. ENAP, a Federal Public School, acts as an innovation intermediary, of-

Tab. 1 – Profile of interviewed participants.

Part.	Initiative	Position
I1	Enap Challenges Platform	General Coordinator of Open Innovation
I2	Enap Challenges Platform	Project Manager
I3	Serpro Ventures	Superintendent of Corporate Architecture, Platforms and Cloud
I4	Serpro Ventures	Superintendent of Business Strategy, Pricing and Innovation

fering support, training, and infrastructure to structure these challenges, fostering tech-driven solutions for government efficiency. For this OI process, ENAP has developed a toolkit consisting of seven steps, organized into three main phases.

1. **Pre-Challenge Launch**: *1) Problem Identification:* The process begins with an analysis to understand the complexity of the problem and its feasibility for OI; *2) Market Interviews:* Before launching a challenge, existing solutions are explored and potential contributions from the private sector are assessed; *3) Challenge Planning:* Defining the format, rules, evaluation criteria, and legal framework.
2. **Challenge Launch:** *4) Dissemination and Participant Mobilization:* The platform is used to publicize challenges to startups, companies, universities, and citizens interested in contributing; *5) Interaction and Co-Creation:* Workshops, hackathons, and other methodologies are employed to foster collaboration between the government and participants.
3. **Post-Challenge:** *6) Solution Development and Validation:* The public agency evaluates the submitted solutions and may contract or incubate the best proposal; *7) Scaling and Implementation:* If the solution is successful, it can be expanded to other areas of government.

4.2. Serpro Ventures

The second unit of analysis, known as Serpro Ventures is a structured innovation program led by SERPRO, a publicly owned private-law company. It fosters collaboration with innovation hubs, universities, and ICTs, engaging public servants, researchers, startups, and society in co-creating technological solutions for public agencies. To implement OI, SERPRO applies various strategic approaches.

1. Web Platform: Registers opportunities and partnerships;
2. Hackathons: Explore new ideas and foster creativity;
3. Prototyping and Design Thinking Sessions: Shape innovative solutions;
4. Public Calls: Ensure transparency and create opportunities for diverse participants;
5. Incentive Programs: Provides vouchers for startups to test SERPRO's APIs.

4.3. Dimensions

In this section, we present the main findings of the thematic analysis, organizing them into five core dimensions (i.e., themes): 1) **practices** – a set of efforts, resources, and strategies applied to enable OI processes; 2) **stakeholders** – internal and external participants who play essential roles in the initiative; 3) **enablers** – internal and external elements that can drive project implementation; 4) **barriers** – obstacles that hinder project execution; and 5) **technology** – the role of technological tools in the development and implementation of the initiative.

These dimensions were defined based on a systematic literature review on OI in the public sector (de Lima Júnior et al., 2024), previously conducted to identify conceptual patterns and theoretical gaps in recent scholarly work. The adoption of these categories provided a robust theoretical framework for the empirical analysis, guiding data coding and case triangulation. To further illustrate the findings, we adapted the C1 (Enap Challenges Platform) and C2 (Serpro Ventures) taxonomy, offering a more structured interpretation of the collected data.

4.3.1. Practices

The "practices" theme in this study comprises 41 characteristics (Table 2), with 36 identified through field research and 5 from a systematic literature review (de Lima Júnior et al., 2024). To organize them, 8 overarching

sub-themes were created. Both Enap Challenges Platform and Serpro Ventures relied on structured methodologies, such as stage gate and toolkits, along with specific tools to streamline the innovation process (I1, I2, I3, I4). Legal frameworks played a crucial role in establishing a favorable environment for innovation, supported by NDAs, licenses, contracts, and patents to ensure protection and compliance (I1, I2, I3). Capacity-building was a key investment in both initiatives, incorporating mentorships, workshops, webinars, training, and interactive sessions to promote continuous learning (I1, I2, I3, I4). Table 3 presents the general characteristics of the approach dimension for both initiatives.

Tab. 2 – Practices being employed in both initiatives

#	Practices	C1	C2	#	Practices	C1	C2
1	**Governance and Strategy**			**2**	**Engagement and Collaboration**		
1	Align Expectations	X	X	12	Bring Stakeholders Closer	X	X
2	Innovation Strategy	X	X	13	Involve External Actors	X	X
3	Strategic Planning	X	X	14	Involve Internal Bodies	X	X
4	Administrative Structure	X	X	15	Capture Ecosystem	X	X
5	Institutional Initiatives	X	X	16	Collaboration	X	X
6	Internal Regulations	X	X	17	Mediation	X	X
7	Risk Mitigation	X	X	18	Partnerships	X	X
8	Cultural Change	X	X	19	Participate in Events	X	X
9	Foster Entrepreneurship	X	X	20	Experience Exchange	X	X
10	Product Innovation		X	21	Communication	X	X
				22	Dissemination	X	X
3	**Knowledge and Tools**			**4**	**Management and Operational Processes**		
23	Innovation Tools	X	X	28	Innovation Management and Processes	X	X
24	Prototyping Sessions	X		29	Problem Management and Resolution	X	X
25	Train the Participants	X	X	30	Assign a Dedicated Team	X	X
				31	Remote Process	X	X
5	**Legal Aspects**			**6**	**Incentives**		
32	Legal Support	X	X	36	Financial Resources	X	X
33	Legal Steps	X	X	37	Sponsorship	X	
34	Legal Instruments	X	X	38	Awards	X	X
35	Contract Formatting	X					
7	**Events**			**8**	**Digital and Technological Enablement**		
39	Competitions	X	X	42	Open Data	X	X
40	Community Challenges	X	X	43	Web Platform	X	X
41	Hackathons	X	X				

Tab. 3 – Characteristics of the "Approaches" dimension

Feature	Sample quotes	Interviewee
Legal Instruments	"(...) having regulations and laws that made this easier (...) is important from the government's perspective."	I4
Innovation Management and Processes	"(...) within the toolkit, it is a very important step"	I2
Intermediation	"(...) ENAP is an intermediary (...) for the government."	I1
Train the Participants	"We initially selected a small group (...) these individuals received extensive training"	I4
Legal Support	"(...) we invested in a consulting firm to structure the regulations for our process, ensuring security."	I4
Engaging External Stakeholders	"(...) we always seek partners that can reach different regions of Brazil, ensuring national participation."	I1

4.3.2. Stakeholders

The data analysis reveals that, for this study, the "stakeholders" dimension consists of 22 main types of stakeholders. Among these, 8 emerged from direct engagement with participants (3, 8, 9, 10, 15, 16, 17, and 18), while the remaining 14 (1, 2, 4-7, 11-14, and 19-21) were identified through a systematic literature review (de Lima Júnior et al., 2024). The data are presented in Table 4.

Startups played a central role in Enap Challenges Platform, while Serpro Ventures, though focused on established companies, also engaged with promising startups to stimulate innovation (I1–I4). Both initiatives maintain connections with universities, with Serpro Ventures aiming to deepen research collaborations (I3, I4). Senior management engagement proved critical for decision-making and resource allocation across both cases (I1–I4). Additionally, Serpro Ventures distinguished itself through strong ties with Innovation Hubs, promot-

Tab. 4 – List of Identified Stakeholders

#	Stakeholders	C1	C2	#	Stakeholders	C1	C2
1	Citizens	X	X	12	Intermediaries	X	X
2	Project Council	X	X	13	Joint Venture	X	X
3	Consultant	X	X	14	R&D Laboratory	X	X
4	Companies	X	X	15	Leadership (Senior Management)	X	X
5	Nonprofit Organizations	X	X	16	Internal Agencies	X	X
6	Internal Employees	X	X	17	CSOs	X	X
7	Government	X	X	18	Technology Park	X	X
8	GovTechs	X	X	19	Researchers	X	X
9	Innovation Hub		X	20	Civil Society	X	
10	ICTs		X	21	Startups	X	X
11	Innovators	X	X	22	Universities	X	X

ing knowledge exchange and dynamic collaboration (I3, I4). Table 5 presents the key stakeholders involved in the OI cycles.

Tab. 5 – Sample quotes of the main stakeholders involved

Stakeholder	Sample quotes	Interviewee
Startups	"(...) open innovation is strongly associated with startups, especially in the tech sector."	I2
Private Companies	"(...) some challenges were open to everyone, while others were restricted to companies."	I1
Government	"(...) in our case, the government has primarily acted as a client, the one requesting the challenge."	I1
Leadership (Senior Management)	"(...) senior management must truly believe in this."	I4
CSOs (Civil Society Organizations)	"(...) we work closely with CSOs and have even signed a cooperation agreement with them, including the Impact Hub."	I2
Universities	"(...) we are entering a new phase where we aim to bring certain stakeholders, especially universities, closer to our ecosystem."	I3
Citizens	"(...) any individual or team can register and submit their solution or proposal."	I1

4.3.3. Enablers

The case study identified key enablers and barriers that influenced the initiatives. A total of 20 enablers were classified, with 10 derived from the systematic literature review (1, 2, 5, 8, 11, 13, 15, 17, 19, 20) and 10 from interview insights (3, 4, 6, 7, 9, 10, 12, 14, 16, 18), reflecting practical experiences. The complete list is presented in Table 6.

Tab. 6 – List of identified enablers

#	Enablers	C1	C2	#	Enablers	C1	C2
1	Open Data	X	X	11	Challenge Promotion	X	X
2	Relaxed Environment	X		12	Innovation Ecosystem	X	
3	Administrative Support	X		13	Empowerment of People	X	X
4	Support from Senior Management	X	X	14	Stakeholder Engagement	X	X
5	External Stakeholders	X		15	Ease of Hiring (Initial Stages)	X	X
6	Training for Participants	X	X	16	Infrastructure		X
7	Success Cases	X	X	17	Relevant Legislation	X	X
8	Collaboration	X	X	18	Financial Resources	X	X
9	Communication	X		19	Technology	X	X
10	Organizational Culture	X	X	20	Transparency	X	X

Relevant legislation provided the legal foundation for OI, ensuring compliance and security (I1, I4). Senior management support was crucial for institutional backing, resource allocation, and strategic alignment (I3). Training enhanced innovation capacity, while successful case studies helped reduce resistance and inspire new approaches (I1, I2, I3, I4). Challenge promotion played a key role in engaging startups, companies, and universities. Strengthening ecosystem connections, including partnerships with innovation hubs and research centers, fostered collaboration and a dynamic innovation environment (I1, I2).

Tab. 7 – Sample quotes of the main enablers

Enablers	Sample quotes	Interviewee
Relevant Legislation	"(...) the legal framework already incorporates approaches such as solution acceleration, institutional arrangements, and the use of the startup legal framework for contracting solution testing."	I1
Financial Resources	"(...) more than 20% of the company's revenue now comes from the products we have launched in recent years."	I4
Successful Case Studies	"(...) our main reference, in fact, is challenge.gov."	I1
Senior Management Support	"(...) having leadership invested in making things happen was very important."	I1
Ease of Contracting	"(...) any contracting process is now easier than it used to be, and open innovation-related contracts are relatively straightforward."	I2

4.3.4. Barriers

The analysis identified 18 barriers affecting the initiatives during the operational phase. Among them, 5 emerged from the systematic literature review (3, 5, 13, 14, 17), while 13 were identified through interviews (1, 2, 4, 6-12, 15, 16, 18). Table 8 presents the main obstacles that had to be overcome for successful implementation.

Tab. 8 – List of identified barriers

#	Barriers	C1	C2	#	Barriers	C1	C2
1	Cultural Aspects	X	X	10	Lack of Time	X	
2	Barriers to Engagement	X		11	Limitations	X	X
3	Legal Barriers	X	X	12	Financial Constraint		X
4	Organizational Barriers	X	X	13	Political Mandate	X	X
5	Bureaucracy	X	X	14	Personal Data Privacy		X
6	Conflicts		X	15	Lengthy Process	X	X
7	Engaging External Agencies	X	X	16	Resistance	X	X
8	Lack of Capacity	X	X	17	Technical Restrictions	X	X
9	Lack of Engagement	X		18	Risk	X	X

A key risk in public sector innovation is the fear of accountability among public servants for procedural failures (I1, I2, I3, I4). While bureaucracy ensures transparency, it often hinders innovation (I1, I2, I3, I4). Additionally, cultural resistance, rooted in hierarchical and traditional structures, further challenges change (I1, I2, I3, 11). Table 7 summarizes the main barriers faced during implementation.

Tab. 9 – Sample quotes of the main barriers

Barriers	Sample quotes	Interviewee
Risk	"(...) the public sector has a strong aversion to risk, including fear of making mistakes and then being penalized for them."	I1
Bureaucracy	"(...) open innovation challenges take a long time to materialize because they must go through all these phases."	I1
Political Mandate	"(...) every political transition requires a significant amount of time for realignment—adjusting priorities and refocusing innovation efforts."	I4
Resistance	"(...) when the public call needs to be launched by the institution itself, that's when we encounter resistance to innovation."	I1
Lack of Capacity	"(...) we often work with teams that have never done this before, or perhaps have minimal experience—which is why they seek us out—but they are not experts in open innovation."	I1

4.3.5. Technology

Technology played a fundamental role in driving these initiatives forward. Regarding its influence on these actions, 16 relevant aspects were identified. Among them, 7 were highlighted during the interviews (5, 6, 8,

11, 12, 14, and 15), while the remaining 9 were extracted from the systematic review analysis (1-4, 7, 9, 10, 13, and 16). Table 10 presents the roles played by technology in these initiatives.

Tab. 10 – List of identified Technology Roles

#	Roles	C1	C2	#	Roles	C1	C2
1	Open Data Provisioning	X	X	9	Intermediating the Innovation Process	X	
2	Development of New Technologies	X		10	Social Media Monitoring	X	X
3	API Provisioning	X	X	11	Process Optimization	X	X
4	Provision of Online Services	X	X	12	Enables Transparency	X	
5	Dissemination	X	X	13	Facilitates Communication	X	
6	Documentation	X	X	14	Remote Process	X	X
7	Process Facilitation	X	X	15	Online Meetings		X
8	Innovation Support Tools	X	X	16	Support for Collaborative Activities	X	X

Table 11 highlights key technology roles in OI. Technological tools enabled continuous collaboration among stakeholders (I2, I4). Dissemination expanded initiative reach and engagement (I1, I3). Technology also improved transparency, ensuring all process stages were documented and accessible (I2, I3).

5. Discussion

5.1. Units of analysis comparison

Based on the five themes of this study, the following similarities can be highlighted in both approaches:

- **Practices:** Both Enap Challenges Platform and Serpro Ventures have institutionalized OI in the public sector through legal frameworks and tailored methodologies (I2, I3, I4), reflecting distinct intermediation logics—open dissemination in the case of ENAP, with online-accessible toolkits, and restricted collaboration in Serpro Ventures, based on stage-gated processes with confidential partners (I3, I4). The nationwide reach of both initiatives reinforces their role as federal intermediaries, aligning with discussions on multilevel innovation governance (Figenschou et al., 2024; Mu and Wang, 2022; Palumbo et al., 2023; Pinto et al., 2024). The emphasis on capacity-building—through training in ENAP and professional development in Serpro Ventures —contributes to the sustainability of innovation (Al Maazmi et al., 2024; Edelmann et al., 2023).
- **Stakeholders:** Both initiatives position public agencies as their primary beneficiaries (I1, I2, I3, I4), reinforcing their intermediary role in public sector-oriented innovation networks (Bakici et al., 2013). Active support from senior management (I1, I3, I4) underscores the importance of institutional leadership as a key enabler of DT (Mergel et al., 2019). While academic partnerships are still in the process of consolidation (I1, I3, I4), they reflect an effort to bridge science and public policy design (Ferraris et al., 2020; Palumbo et al., 2023). In parallel, engagement with CSOs (I2, I3) strengthens participatory models of governance (Figenschou et al., 2024).
- **Influencing Factors:** Access to financial resources is critical for investments in platforms, licenses, and experimental initiatives (I1, I2, I3, I4), as highlighted in studies on the sustainability of public innovation (Al Maazmi et al., 2024; Georghiou et al., 2014). Participation in innovation events and forums (I1, I2, I4) serves as a strategy for stakeholder engagement and institutional legitimation (Bogers et al., 2018). Nevertheless, structural barriers such as bureaucratic rigidity and risk aversion continue to hinder collaboration with startups and technology firms (I1, I2, I3, I4).

Tab. 11 – Sample quotes of the main technology roles

Roles	Sample quotes	Interviewee
Open Data	"When data is already open, that is the ideal scenario."	I2
Innovation Support Tools	"(...) using Discord to maintain communication with registered teams, networks—every one of our challenges has a technological component."	I1
API Availability	"(...) we have already used APIs and platforms to support technology development."	I1
Supporting Collaborative Activities	"(...) we rely heavily on technology, using Miro for virtual events that require intense collaboration."	I3

- **Role of Technology:** Technology plays a central role by enabling interoperability between systems through APIs (I1, I3) and facilitating synchronous and asynchronous interactions via platforms such as Discord, Zoom, YouTube, and WhatsApp (I3, I4). These tools enhance collaboration and transparency, contributing to more open digital ecosystems (Gong et al., 2020; Verhoef et al., 2021). The dual role of technology—as both technical infrastructure and a sociotechnical mediation mechanism—aligns with contemporary perspectives on DT in the public sector (Tiach and Abdellatif, 2023; Vial, 2019).

Digital Transformation, driven by OI, enhances engagement, collaboration, and strategic partnerships. For its effective implementation, it is essential to address aspects such as bureaucracy, infrastructure, organizational culture, resource allocation, and capacity building, ensuring sustainable and impactful progress.

5.2. Related work

In this section we position our results compared to a summary of findings from two recent literature reviews on public OI: Mu and Wang, 2022 focused on barriers for OI while Palumbo et al., 2023 brings a broader perspective that cover similar themes as we had.

Some of the barriers we identified to OI align with the barriers identified by Mu and Wang, 2022. These similarities illustrate how traditional barriers to OI persist across digital and administrative domains. E.g., **Technical Restrictions** pose a significant hurdle, closely mirroring the broader challenge of Technical Difficulties, which includes issues related to system service quality, infrastructure, and professional expertise. Similarly, **Lack of Capacity**, **Organizational Barriers**, and **Bureaucracy** reflect the problem of Limited Organizational and Political Capacities, where rigid structures and insufficient resources hinder the adoption and implementation of OI.

Many of the OI practices we identified align with those found in the literature (Palumbo et al., 2023). For instance, **Governance and Strategy**, which includes **Align Expectations**, **Innovation Strategy**, and **Strategic Planning**, corresponds to Public-Private Partnerships (PPPs) and Public-Private-People Partnerships (PPPPs), as both emphasize structured collaboration frameworks between government entities, private organizations, and civil society to drive innovation. **Institutional Initiatives** and **Internal Regulations** also support Open Government Data Initiatives, as they establish the regulatory frameworks necessary for data-driven transparency and innovation. Similarly, **Engagement and Collaboration**, which includes **Bring Stakeholders Closer**, **Collaboration**, and **Partnerships**, aligns with Co-Creation Models, where multiple actors actively participate in the design and implementation of innovative solutions.

The key **stakeholders** of POI mapped by Palumbo et al., 2023 include government entities and public administrations, private sector companies, academia and research institutions, non-governmental organizations (NGOs) and third-sector organizations, and citizens and civil society. These are are also similar to what we mapped.

Similarly, our identified POI enablers align with those from Palumbo et al., 2023 as well. For example, **Open Data** corresponds to technological infrastructures, such as open data platforms and digital collaboration tools, as both emphasize the role of accessible and interoperable data in fostering innovation. Similarly, **Support from Senior Management** and **Administrative Support** align with financial and relational support from public sector entities, highlighting the importance of leadership and institutional commitment in sustaining innovation efforts. The role of **Stakeholder Engagement**, **Collaboration**, and **External Stakeholders** corresponds to trust-building mechanisms to enhance stakeholder engagement, as both recognize the necessity of fostering meaningful relationships and cooperation across sectors. Likewise, **Training for Participants** and **Empowerment of People** align with knowledge-sharing networks to support cross-sector partnerships, ensuring that stakeholders have the necessary skills and opportunities to contribute effectively.

Our findings highlight the critical role of technology in enabling **Open Data provisioning**, which aligns with Palumbo's (Palumbo et al., 2023) concept of Data-Driven Innovation, ensuring that stakeholders can access government-held information to drive new solutions. The **Development of New Technologies** and **API Provisioning** directly contribute to Facilitating Knowledge Flows, fostering continuous inflows and outflows of knowledge that enhance cross-sectoral collaboration. Additionally, **Provision of Online Services** and **Dissemination** are key in Transparency and Open Governance, ensuring accessibility to innovation-driven ini-

tiatives. The **Intermediating the Innovation Process** and **Innovation Support Tools** closely match Orchestrating Multi-Actor Innovation, as they enable coordination among diverse stakeholders within a structured ecosystem.

Only one comparable study focuses on the municipal level (de Lima-Junior et al., 2024), revealing several shared findings. Both highlight the **importance of legal and methodological frameworks**, the need for **stakeholder engagement** and high-level administrative support, and the relevance of **university partnerships** and **collaboration with civil society** in fostering innovation. They also identify **funding** as essential for sustaining initiatives. Common barriers include **bureaucracy and risk aversion**, which hinder participation. Finally, both studies recognize **technology as a facilitator** of OI, particularly through APIs, digital platforms, and open data.

This study contributes to the field of digital government by deepening the understanding of the role of federal public institutions as intermediaries in OI ecosystems—a topic still underexplored in the specialized literature. Its originality lies in the comparative analysis of cases operating under different institutional configurations but sharing the strategic function of articulating multiple actors, fostering interorganizational collaboration, and enabling distributed DT. The relevance of the phenomenon under study is underscored by the growing challenges faced by governments in contexts marked by resource scarcity, complex demands, and the need for agile and collaborative solutions. The research offers theoretical and empirical insights to rethink governance models, expand institutional capacities, and strengthen data-driven and participatory public policies.

5.3. Limitations

This study has some limitations. First, analyzing only two cases may limit the generalizability of the findings, as they may not fully capture the diversity of experiences in similar contexts. Second, the thematic analysis was primarily conducted by a single researcher, introducing potential bias despite later discussions with two others to enhance rigor. Future research could expand the number of cases and involve more analysts to enhance the reliability of findings and reduce subjectivity. Moreover, it is important to investigate the role of other federal institutions that adopt different models of intermediation, as well as to analyze the impact of such initiatives at subnational levels of government, contributing to a more comprehensive understanding of open innovation in the public sector.

6. Conclusions

The empirical investigation conducted in this case (Enap Challenges Platform and Serpro Ventures) highlights innovative pathways and promising strategies for DT in federal agencies. The incorporation of OI has driven significant changes in organizational culture, resulting in substantial improvements in the quality of public services provided to citizens.

The analysis of data obtained from both initiatives reveals strategic actions aimed at improving public services and strengthening the relationship between government and society through OI. The study emphasizes the active participation of various stakeholders in public administration, highlighting the essential role of citizens. As key drivers of DT, citizens exert a direct influence on the adoption of innovative practices by government agencies. In this regard, positioning citizens at the center of the public debate is fundamental to understanding their expectations and needs concerning urban development. This approach reinforces a strategic direction focused on creating innovative solutions through collaboration, ensuring that public demands are met more effectively.

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